

Claims

1. Apparatus for the combined drug/electric stimulation treatment of a cardiac muscle, comprising circuitry for creating a non-excitatory electric potential between at least two points located in the vicinity of a muscle.
2. Apparatus as claimed in claim 1, comprising circuitry for controlling the start time of the electric potential generated between said at least two points.
3. Apparatus as claimed in claim 1, comprising circuitry for controlling the duration of the electric potential generated between said at least two points.
4. Apparatus as claimed in claim 1, comprising circuitry for controlling the magnitude of the electric potential generated between said at least two points.
5. Apparatus as claimed in claim 1, wherein the circuitry for creating a non-excitatory electric potential between said at least two points comprises one or more electrode.
6. Apparatus as claimed in claim 5, wherein the electrodes are carbon electrodes.

7. Apparatus as claimed in claim 1, which is an insertable device.
8. Apparatus as claimed in claim 1, which is an extra corporal device.
9. Apparatus as claimed in claim 1, which is an implantable device.
10. Apparatus as claimed in claim 2 or 3, wherein the circuitry for controlling the start time and/or duration of the electric potential is synchronized to heart activity.
11. Apparatus as claimed in claim 10, wherein the circuitry for controlling the start time and/or duration of the electric potential operate not at every beat of the heart.
12. Apparatus as claimed in claim 11, wherein the circuitry for controlling the start time and/or duration of the electric potential operates every 1, 2 or 3 beats of the heart.
13. Apparatus for the combined drug/electric stimulation treatment, comprising circuitry for causing a non-excitatory electric current to flow between at least two points located in the vicinity of a muscle.

14. Apparatus as claimed in claim 13, comprising circuitry for controlling the start time of the electric current flowing between said at least two points.)
15. Apparatus as claimed in claim 13, comprising circuitry for controlling the duration of the electric current flowing between said at least two points.
16. Apparatus as claimed in claim 13, comprising circuitry for controlling the magnitude of the electric current flowing between said at least two points.
17. Apparatus as claimed in claim 13, wherein the circuitry for causing a non-excitatory electric current to flow between said at least two points comprises one or more electrode.
18. Apparatus as claimed in claim 17, wherein the electrodes are carbon electrodes.
19. Apparatus as claimed in claim 13, which is an insertable device.
20. Apparatus as claimed in claim 13, which is an extra corporal device.

21. Apparatus as claimed in claim 13, which is an implantable device.

22. Apparatus as claimed in claim 14 or 15, wherein the circuitry for controlling the start time and/or duration of the electric current is synchronized to heart activity.

23. Apparatus as claimed in claim 22, wherein the circuitry for controlling the start time and/or duration of the electric current operate not at every beat of the heart.

24. Apparatus as claimed in claim 23, wherein the circuitry for controlling the start time and/or duration of the electric current operates every 1, 2 or 3 beats of the heart.

25. Apparatus as claimed in ^{claim} ~~any one of claims 1 to 24~~ ^{or 13}, wherein the non-excitatory electric current is a DC electric current.

26. Apparatus for the combined drug/electric-stimulation treatment of a cardiac muscle, comprising:

- means for creating an electric potential between at least two points located in the vicinity of the cardiac muscle;
- means for causing a non-excitatory electric current to flow between said at least two point; and

- means for controlling the start time, duration and magnitude of the electric current flowing between said at least two points.

27. Apparatus according to claim 26, comprising:

- means for creating an electric potential between at least a pair of electrodes in the vicinity of the cardiac muscle at at least two root locations;

- means for causing a non-excitatory electric current to flow between said at least two root locations; and

- means for controlling the start time, duration and magnitude of the electric current flowing between said at least two root locations.

28. Apparatus according to claim 26 or 27, further comprising means for superimposing on the DC signal one or more waveforms of given frequency and amplitude, thereby to generate a complex signal.

29. A method for the combined drug/electric stimulation treatment of a cardiac muscle, comprising a) administering to a patient in need thereof a drug which affects the cardiovascular system and which affects the cardiac muscle, or a mixture of two or more such drugs, b) creating a non-excitatory electric potential between at least two points located in the vicinity of the muscle, and c) controlling one or more of the parameters consisting of start time, duration, magnitude and polarity of the non-excitatory electric potential created between said at least two points.

7/ 35. A method according to claim 34, wherein the non-excitatory DC electric current flows every 1, 2 or 3 beats of the heart.

8/ 36. A method for the combined drug/electric-stimulation treatment of a cardiac muscle, comprising:

- administering to a patient in need thereof a drug which affects the cardiovascular system and which affects the cardiac muscle, or a mixture of two or more such drugs;

- providing means for creating an electric potential between at least two points located in the vicinity of the cardiac muscle;

- providing means for causing a non-excitatory electric current to flow between said at least two point; and

- controlling the start time, duration and magnitude of the electric current flowing between said at least two points so as to impart a desired change in cardiac muscle contractility.

a 9/ 37. A method according to any one of claims ^{1, 2, 8}~~29 to 36~~, wherein the change in cardiac muscle contractility is designed at least partially to compensate for cardiac muscle contractility decrease induced by said drug or mixture of drugs.

a 10/ 38. A method according to any one of claims ^{1, 2, 8}~~29 to 36~~, wherein the change in cardiac muscle contractility is designed at least partially to compensate

for cardiac muscle contractility increase induced by said drug or mixture of drugs.

a 11/ ^{1 2 8}
~~29, 30, and 36~~
39. A method according to any one of claims ~~29 to 36~~, wherein the change in cardiac muscle contractility is designed to add to and/or amplify the cardiac muscle contractility increase or decrease induced by said drug or mixture of drugs.

a 12/ ^{1 2 8}
~~29, 30, and 36~~
40. A method according to any one of claims ~~29 to 36~~, for reducing the dosage of a cardiovascular drug which affects cardiac muscle contractility.

a 13/ ^{1 2 8}
~~29, 30, and 36~~
41. A method according to any one of claims ~~29 to 36~~, for reducing the dosage of a cardiovascular drug which affects the electrophysiological characteristics of the cardiac muscle.

14/
42. A method for the combined drug/electric-stimulation treatment of a cardiac muscle, comprising:

- administering to a patient in need thereof a drug which affects the cardiovascular system and which affects the cardiac muscle, or a mixture of two or more such drugs;

- providing an electric potential between at least a pair of electrodes in the vicinity of the cardiac muscle at at least two root locations;

- causing a non-excitatory electric current to flow between said at least two contacting locations; and

- controlling the start time, duration and magnitude of the electric current flowing between said at least two root locations, so as to impart the desired change in cardiac muscle contractility.

15/ 43. A method according to claim 42, wherein the means for causing a non-excitatory electric current to flow, are synchronized to heart activity.

16/ 44. A method according to claim 43, wherein the means for causing a non-excitatory electric current to flow operate not at every beat of the heart.

17/ 45. A method according to claim 44, wherein the means for causing a non-excitatory electric current to flow operate every 1, 2 or 3 beats of the heart.

18/ 46. A kit for the treatment of cardiovascular diseases, comprising a drug or a combination of two or more drugs, and an apparatus according to any one of claims 1 to 29. ^{1, 13, and 26}

a 19/ 47. Apparatus as claimed in any one of claims 1 to 26, comprising circuitry for controlling its activity as a function of calculated and/or actual level of a given drug or combination of drugs in the patient's blood. ^{2 8 1, 13, and 26 36}

a 48. Apparatus according to any one of claims 1 to 26, for use in reducing the dosage of pro-arrhythmic drugs. ^{2 8 1, 13, and 26 36}

a 49. Apparatus according to any one of claims ^{1, 13, and 26} ~~1 to 26~~, for use in counteracting side-effects of pro-arrhythmic drugs.

a 50. Apparatus according to any one of claims ^{1, 13, and 26} ~~1 to 26~~, comprising timing circuitry for activating it at predetermined times during the day.

51. A method for the combined drug/electric-stimulation treatment of a cardiac muscle, essentially as described and with particular reference to the examples.

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